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THE NARCISSUS BULB FLY AND ITS CONTROL IN BRITISH COLUMBIA[1]

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The narcissus bulb fly[2] is the most important insect affecting the recently expanded narcissus bulb industry in the coastal areas of British Columbia. In 1949 the infestation was the greatest ever experienced, being as high as 75 per cent in some fields in which bulbs were left for two to four years for cut flower production and in which control was not undertaken.

DISTRIBUTION

Considered a native of southern Europe, the narcissus bulb fly appeared in the bulb areas of northern Europe early in the nineteenth century. It was found in the United States as early as 1879, and in Canada, in British Columbia, in 1908. It is now established throughout the bulb-growing sections of the United States and Canada, and has been increasing in importance annually.

HOST PLANTS

The narcissus bulb fly is mainly a pest of daffodils (narcissi). Occasionally it attacks snowdrops, amaryllis, hyacinths, lilies, tulips, and other bulbous plants.

DESCRIPTION OF INSECT

The adult is a robust, hairy, two-winged fly about half an inch long, greatly resembling a small bumble bee. It varies considerably in color; it may be black with yellow, orange, or grey bands, or any one of these colors may predominate.

The egg is chalk-white, similar to a jelly-bean candy in shape, and about a sixteenth of an inch long.

On hatching, the larva, or maggot, is about a sixteenth of an inch long. It sheds its skin twice as it develops and when full-grown is about three-quarters of an inch long. The mature larva has a plump, slightly arched body, nearly circular in cross-section, with a tough, wrinkled skin. The head is slightly tapered and bears black mouth hooks, which are used to tear the bulb tissue.

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[1] Revision of Processed Publication Series 117 - Entomology Division.

[2] Lampetia equestris (F.)

The skin of the mature larva hardens and becomes a pupal case (puparium), in which the pupa transforms to the adult fly. The brown, oval puparium is half an inch long and a quarter of an inch wide, has wrinkled, tough skin, and is rounded at both ends.

DESCRIPTION OF DAMAGE

The newly hatched larva enters the bulb through the root-ring of the basal plate. Using its mouth hooks, it tunnels back and forth in the tissue of the basal plate for several weeks, and then moves upward into the scales, usually toward the flower parts. As the larva grows, the tunnel lengthens; and eventually the centre of the bulb becomes a cavity filled with soft, brown, decayed bulb tissue. Small bulbs are generally destroyed and large ones seriously damaged. In large bulbs, sufficient basal plate tissue remains undamaged to permit the bulb to make some growth, but it takes two or three years for the bulb to return to normal. If the bulb is not too seriously damaged, it will develop but will have fewer leaves than normally; these are small and grassy in appearance.

In the fall, before planting the bulbs, one may detect some of the infested ones by examining the basal plate. Removing the soil and old roots with a small brush, and scraping with a knife, aids in this examination. Presence of a maggot in the bulb is indicated by a brown, sunken portion of the root-ring that surrounds the base. This dark-brown discoloration often extends upward on the side of the bulb above the point where the maggot entered.

Under favorable weather conditions in the coastal areas of British Columbia, the larvae have been observed to ruin the flower parts of 50 per cent of the infested bulbs by the end of the first week in August.

LIFE-HISTORY AND HABITS

The flies occur from the first week in May to the beginning of July and are active chiefly on bright, warm days. They feed on pollen and nectar from the blossoms of such plants as strawberry, apple, morning glory, dandelion, and many others. They fly among the plants in zigzag fashion and generally along the rows, about eight to ten inches above the ground. The flies are more likely to be found in sheltered places; consequently, narcissi planted in open, windswept fields usually have light infestations.

The female lays about 40 eggs, placed singly on the soil or foliage as near the bulbs as possible. When laying she crawls down a crack or crevice that remains in the soil when the foliage dies down and shrivels. The egg hatches in 10 to 15 days and the minute larva moves downward to the base of the bulb. It enters through the basal plate and subsequently feeds on the interior of the bulb, developing to mature size by late September or October. Usually one larva develops in a bulb, but occasionally two may be present and, rarely, three or four. The larvae remain in the bulbs during the winter, leaving them in March or April to form puparia at the soil surface in the bulb row. It is from these puparia that the flies emerge during early May. The normal life-cycle is completed in one year.

CONTROL

Control measures are of three kinds: (a) cultural practices, (b) field treatments to prevent attack by the larvae, and (c) after-harvest treatments to kill larvae present in the bulbs.

Cultural Practices

When planting, destroy unduly soft bulbs because they are likely to be infested by larvae. Most experienced growers discard such bulbs but often neglect to destroy them. Destruction is essential and can be easily and economically done by placing the bulbs in a pile, coating them with discarded crankcase or stove oil, and burning them. A fire from about one gallon of oil will reduce 500 bulbs to ashes.

Narcissus bulb fly on narcissus leaf. Natural size.

Vertical section of narcissus bulb showing extensive injury in October, when the maggot is mature. Natural size.

The bulbs left by chance in the field at digging time, commonly referred to as "volunteers", may be infested by the bulb fly. As such bulbs are a serious source of infestation, collect and destroy them before any mature larvae begin to emerge from them, i.e., before March 1.

FIELD TREATMENTS

1. Bulb Treatment at Planting

Experiments conducted at Victoria during the past two years have shown that the larvae can be prevented from entering narcissus bulbs by a treatment at planting time with either aldrin or chlordane. You may (a) dust the bulbs in the furrow, before covering them with soil, (b) spray them in the furrow, before covering them with soil, or (c) soak them for ten minutes in cold water mixture before planting.

Dusting Method. -- After placing the bulbs in the furrow, and before covering them with soil, thoroughly dust them with either 2½ per cent aldrin or five per cent chlordane dust. Apply either material by hand or with a fertilizer spreader at the rate of three pounds per 200 feet of row, or 200 pounds per acre for rows planted three feet apart. The most suitable spreader is one with holes in the bottom of the hopper, about three-eighths of an inch in diameter and one inch apart. Leave 11 holes open so that the insecticide is spread evenly over a 10-inch swath.

Spraying Method. -- After placing the bulbs in the furrow and before covering them with soil, spray them with either aldrin or chlordane emulsifiable concentrate. Apply either material with a row-crop sprayer similar to that described in the pamphlet "A Home-made sprayer for attachment to a tractor power take-off", available from the Canada Department of Agriculture. By operating a rotary gear pump from the tractor power take-off and adjusting the nozzles over the furrow to cover a 10-inch swath, you may obtain complete bulb and soil coverage. Use two flat-type nozzles, Tee jet 8008, directed at a 45-degree angle and about six inches above the row of bulbs. Travel at three miles per hour and operate the pump at 100 p.s.i. so that you apply about 100 gallons of spray per acre. To apply five pounds of actual aldrin or ten pounds of actual chlordane per acre, use 2½ gallons of 20 per cent aldrin (liquid concentrate) or 1¼ gallons of 65 per cent chlordane (liquid concentrate) per 100 gallons of water per acre.

The cost of aldrin or chlordane, applied by the dust or the spray method, is approximately $25 an acre. It is not known definitely whether these two insecticides prevent the larvae from entering bulbs left in the treated furrows for a second year for the cut-flower trade.

Soaking Method. -- Before planting, soak the bulbs for ten minutes in an emulsifiable concentrate (emulsion) of either aldrin or chlordane. Use 20 per cent aldrin at the rate of 1½ gallons (three pounds of actual aldrin) per 100 gallons of water. Chlordane is sold as a 40 per cent or a 65 per cent emulsion. Use the 40 per cent liquid at the rate of 1¼ gallons, and the 65 per cent emulsion at the rate of five pints (five pounds of actual chlordane), per 100 gallons of water. To prevent the spread of basal rot disease, add a fungicide to the aldrin or chlordane mixture in the treating tank. Use formalin at the rate of two quarts, or phenyl mercuric acetate at three ounces, per 100 gallons of water. The cost of these materials per 100 gallons of water is approximately $11.

Both aldrin and chlordane may be fatal if swallowed. Avoid skin contact and

excessive inhalation. Do not breathe vapor, fumes, or spray mist. Avoid contamination of feed and foodstuffs.

2. Field Treatments after Planting

If you do not treat at planting time, then the most satisfactory control for large plantings is an application of summer oil emulsion in combination with methoxychlor. Use one gallon of actual oil and two pounds of 50 per cent methoxychlor powder per 100 gallons of water. Apply this spray at 150 to 200 gallons per acre, or 1½ to two gallons of spray per 100 feet of row, at approximately 100 pounds' pressure. Make four applications at 10- to 15-day intervals, commencing the second week of May. Commercial summer oil emulsions (Saybolt viscosity 65-80 at 100°F.; U.R. 70 per cent or over) are available in British Columbia and usually contain 65 per cent oil. This means that 1½ gallons of the emulsion are required per 100 gallons of water. The cost of the commercial summer oil emulsions is $1.50 per gallon in small quantities. The 50 per cent methoxychlor powder costs approximately $1.00 per pound.

Naphthalene flakes (refined) at 200 pounds per acre, or one pound per 75 feet of row, have given satisfactory control when applied three times at 15-day intervals, commencing during the second week of May. Hilling or mounding the soil to cover the flakes after each application ensures best results. Naphthalene, costing approximately 17 cents per pound, is expensive on an acreage basis and is more suitable for home gardens, or small plantings of high-priced bulbs.

Whatever material is used, apply it to the neck area of the bulb at the soil surface. It is here that the eggs are deposited and the insecticide may kill either the eggs or the newly emerged larvae.

AFTER-HARVEST TREATMENTS

In all bulb or storage treatments it is important that the bulbs be dug and treated as early as possible, before the larvae have caused any damage to the flower parts in the bulbs.

1. Hot-water Treatment -- If properly used, hot water is excellent for treating planting stock known to be infested by the bulb fly or by eelworms. Dig the bulbs as early as possible and treat them after they are cured, i.e., two to three weeks after lifting. For bulb fly control, immerse the bulbs for one hour in water containing formaldehyde, two quarts per 100 gallons, and maintained at a temperature of 110-111°F. A period of three hours is necessary for eelworms.

A few items considered essential are: (a) The tank should be rectangular in shape; (b) heat should preferably be applied as steam or hot water in coils from a boiler of sufficient capacity to bring the bath up to the required temperature as quickly as possible; (c) the water of the bath should be circulated or agitated in the tank by means of a boat-type propeller, driven by a motor, or by means of water pump circulation; (d) the tank should be equipped with an automatic device for controlling the temperature and maintaining it within closely defined limits; (e) the tank should be large enough to handle the stock of bulbs within reasonable time; (f) proper bulb containers, such as wire-mesh boxes or wooden bulb tray racks, should be used; (g) an accurate thermometer that may be read conveniently while its bulb is immersed in the water is essential.

2. Methyl Bromide Fumigation -- As an alternative to the hot-water treatment, fumigate the bulbs with methyl bromide in a chamber, specially constructed for the

purpose, at three pounds per 1,000 cubic feet for 4½ hours at 60°F. Treat the bulbs as soon as they are harvested, provided that the temperature at the centre of the bulb is 60°F. before fumigation. This method is particularly useful for treating infested bulbs that are to be shipped, or used for the forcing trade. Methyl bromide costs approximately 75 cents per pound. It is sold in one-pound cans, convenient for use in a simple and economical Jiffy applicator.

For further information write to the Fruit Insect Section, Entomology Laboratory, c/o Parliament Buildings, Vicortia, B.C.

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